

Risk and Vulnerability of Markets to Fire Incidents in Port Harcourt Metropolis Rivers State, Nigeria

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Fire safety awareness is the ability to recognize the danger of fire, ability to know what to do to prevent a fire as well as what action to take when it occurs. This paper examined the risk and vulnerability of markets to fire incidents in Port Harcourt Metropolis. The cross sectional research method was adopted. Markets in the Metropolis were listed and a random sample technique applied to select six of the markets with an estimated population of traders. Taro Yamane technique was applied to get the sample size. A total number of 382 traders were interviewed in the sampled markets. Primary and secondary sources of data were utilized and key informant data was analysed using discreet statistics and presented in tables and charts. The results showed that fire occurrence could be stopped through fire safety awareness by traders. The risk of fire outbreak was higher in the dry season, the harmattan season. The harmattan season starts between November and March, and comes with dust and mist. This study revealed that it was scary to note that fire incidents recorded in quick succession in Rivers State particularly in the dry season from 2013 to 2018 was alarming. The way out of the situation was the installation of water sprinklers and hydrants at strategic areas of the markets for easy supply of water during fire outbreaks and adequate safety awareness adopted by the traders on handling electrical equipment, storage of chemicals and flammable substances.

Keywords: Risk, Vulnerability, Markets, Fire-Incidents, Port Harcourt.

INTRODUCTION

Fire outbreaks in Port Harcourt market have posed tremendous and devastating damages to lives and properties of traders and as well as shop owners and the government of the state at large. Despite these incidents, many traders are still careless in the handling electrical equipment, storage of chemicals and flammable substances and the result was fire

incidents. Furthermore, the bottlenecks experienced by private individuals, establishments and even the government institutions in managing fire, incidents and the preparedness measures are being viewed from the perspective of the attitudinal behaviour on the part of traders, households, institutions and residents as leap service (Bohner and Wänke,

2002) as also observed in this study. According to (NEMA, 2012) “ A disaster describes the situation where the occurrence of abnormal or infrequent hazardous event has impact on the communities, causing substantial damages, disruption and possible casualties and leaving the affected communities unable to function normally without external assistance” The common causes of fire outbreaks in markets, residences and institutions includes; storage of fuel in market, chemicals in offices, lit candles, gas cookers, stoves, bad electrical connections, adulterated kerosene or fuel etc (Cobin, 2013). Some of the fire incidents recorded includes the creek road market fire incident in 2014, Mile three market fire of 29th December 2014, the mile one market which has had several fire incidences and the most recent was on 17th December, 2013, Rumuokoro market 2017, Port Harcourt slaughter market fire 2017, and the most recent fire incident at the popular fruit garden market in Port Harcourt on 28th September, 2018. These fire incidents and others have cost the traders and the government huge sums of money and properties worth billions of naira lost (Rivers State Fire Service, 2018). Furthermore, the chief fire officer, Rivers State fire service in an interview reported that over 400 emergency calls were received on fire related issues in one year and that in 2013 alone that about 230 lives were lost to fire out breaks. It was against this backdrop that this paper seeks to examine the risk and vulnerability of the markets in Port Harcourt Metropolis to fire outbreaks and proffer solution to curb its incessant occurrences.

Aim and Objectives of the study

The study seeks to examine the risk and vulnerability of markets to fire incidents in Port Harcourt Metropolis in Rivers State.

Objectives of the study are to;

- (i) Identify the factors responsible for the frequent outbreaks of fire in these markets.
- (ii) Identify the time and seasons that fire outbreaks mostly occurs in the markets.
- (iii) Examine the constraints of the agencies involved in firefighting in the Metropolis.
- (iv) Assess the effects of the fire incidents on the traders as well as the government.
- (v) Assess level of safety awareness of traders and measures put in place to stem further inferno.

Fire Safety Awareness

Fire safety awareness is the ability to recognize the danger of fire, ability to know what to do to prevent a fire as well as what action to take in case its occurrence. Fire disasters preparedness is based on the knowledge about fire hazards, the likelihood of different causes of fire outbreaks and the likely effects on the built and natural environment (Muind, 2014). According to (Wisner et al., 2004) people with knowledge about fire disasters will acquire equipment such as fire extinguishers, fire blanket and smoke detectors and alarms among others to support response activities. They also prepare their families and employees to take immediate actions to prevent death, injury, and destruction of property whenever such disaster strikes. Safety awareness and control in UK, USA and other developed countries imposes mandatory fire safety training to all employees, traders, construction workers and other household residents. This helps all concerned with crucial information on disaster response strategies, develop skills on effective use of fire extinguishers and other fire prevention gadgets and proper escape behaviors (Ebhadaghe , 2012).

Risk and Vulnerability of Markets to fire outbreaks

According to (Smith, 2004) the reduction of vulnerability of fire out breaks in homes, markets and institutions has been to determine the prevalent type of burglary proof used in the homes, markets, institutions and perceptions to trapping during fire accidents. The study by Olaitan, (2004) carried out in Olorunda local government area in Osun State, revealed that fire incidents in the market destroyed about 73.4% of goods and properties of traders worth millions of naira. The same study revealed that about 83.6% of the traders admitted lack of awareness to the various measures to prevent fire out breaks and use of fire extinguishers, knowledge of devices such as fire alarms, smoke detectors and other measures were not known. These makes the trader vulnerable and at risk to fire incidents. Reduction to vulnerability to fire out breaks has been viewed from different perspectives; one such framework is the pressure and Release (PAR) model. The model views disaster as the intersection of two major forces; those processes generating vulnerability on one hand and the natural event on the other. Pressure and Release (PR) approaches

Table 1. List of sampled market and estimated population.

s/n	Markets	Estimated Population
1	Port Harcourt New layout market	750,000
2	Mile 1 Market	850,000
3	Mile 3 market	750,000
4	Rumuokoro Market	510,000
5	Oginigba slaughter market	550,000
6	Kaduna street fruit garden market	650,000
	Total	4,060,000

underscore how disasters occur when natural hazards affects people (Wisner, 2002).

Concept of Risk

Risk, according to (USEPA, 1991) is the probability of injury, disease or death under specific circumstances. It may be expressed in quantitatively terms with values from 0 – 1 or described qualitatively as high or low. All human activities carry some degree of risk. According to Smith, (2004), the risk pervades all human activity. A mathematical concept of risk can be represented as the product of probability of adverse event and the severity of the occurrence. This is expressed in the equation below;

$$\text{Risk} \left(\frac{\text{Consequence}}{\text{Unit time}} \right) = \frac{\text{Frequency}(\text{Events})}{\text{Unit time}} \times \frac{\text{Magnitude}(\text{Consequence})}{\text{Event}}$$

Generally,

$$\text{Risk} = P_c + f(P, c, x)$$

$$\text{Risk} = f(\text{hazard, exposure, safeguards})$$

Where f is a function of P , c and other relevant variables x . P is the probability and c is the consequence of the event. According to (Asante-Duah, 2008) risk could be defined as the likelihood to cause harm as a result of exposure to hazardous situation. This is illustrated with a Venn diagram.

METHOD OF STUDY

The study adopted a cross sectional survey research method, investigating the risk and vulnerability of Markets in Port Harcourt Metropolis to incessant fire outbreaks. The quantitative design was chosen to obtain accurate and meaningful data for the phenomenon under study. There were about

fifteen (15) listed markets with estimated population of traders in the Metropolis. The random sampling method was applied and about six markets were chosen for the study. The selected markets are shown in Table 1 with estimated number of traders as obtained from market masters. Sample size was estimated at 95% confidence interval using the Taro Yamane formula (1967);

$$n = \frac{N}{1 + N\alpha^2}$$

Where; n = sample size, N = total estimation of population at the sampled markets
 $\alpha = 0.05$

$$n = \frac{4060,000}{1 + 4060,000(0.05)^2} = 400$$

Table 1 show the six sampled market and Taro Yamane formula was applied to derive the sample size 400 respondents from the selected markets. Open and closed ended questionnaires were well structured to elicit the major issues stated in the objective of the study. A total number of 400 questionnaires were distributed to the sampled markets and 382 were retrieved. The data collected was analyzed by the use of mean and rank order Statistics. The Likert scale was weighted in the design of the questionnaires as follows;

Strongly Agree (SA) -1 point
 Agree (A) - 2 points
 Undecided (UD) -3 points
 Disagree (D) - 4 points
 Strongly Disagree - 5 point

Weighted Means: This was gotten by adding all the points and dividing by the number of options. For example $\frac{5+4+3+2+1}{5} = 3.0$. This implies that item mean lower than 3.0 will be accepted, while those

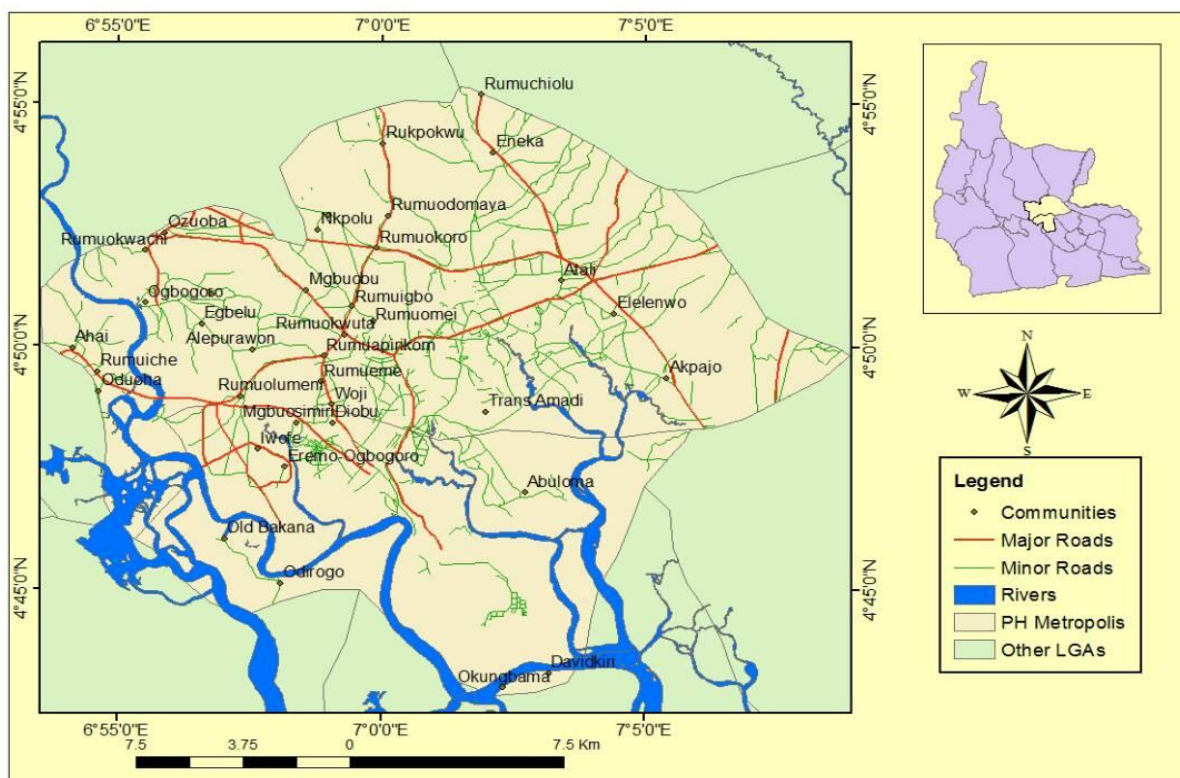


Figure 1. Showing Port Harcourt Metropolis, Rivers State Nigeria. (Geography and Environmental Management (GEM) Cartographic Laboratory, 2018).

higher than 3.0 will be rejected. The comparison between means were tested at 95% confidence interval ($p=0.05$) using z test. Furthermore the Risk and Vulnerability of the traders to fire incidents were determined using the risk concept equation as shown above.

RESULTS

The results of the field survey are presented as follows. On the issue of gender categories, the total number of male respondents were 176 (46%), while that of females 206 respondents (54%) as shown in **Figure 3**. The age categories of respondents were also determined, the analysis showed that the greater number of respondents were youths between 18-24 years age bracket (49.73%) as shown in **Figure 4**. The **Figures 1** and **2** explains the different gender and age categories.

Furthermore, on the educational attainment of traders as shown in **Figure 5** in the various markets the following responses were received, primary

education 50(13.08%), secondary education 100(26.17%), tertiary education 200 (52.35%), Artisan 10 (2.61%), while uneducated were 22(5.75%). The **Figure 3** lends credence the explanation. **Table 2** shows responses on perception of traders on factors responsible for frequent fire outbreaks in Port Harcourt. For Item 1; 145(37.9%) traders reported strongly agree, 155(40.5%) shows agree, 47(12%) were undecided and only 35(9.1%) disagree from the entire respondents that electrical faults was responsible for the frequent fire outbreaks. In item 2; 175(45%) strongly agree, 112 (29.3%) agree, 65(17.0%) were undecided and 30(7.8%), of the total respondent agreed that stored fuel and other flammables substances were responsible. For item 3; 280(73.2%) strongly agree, 60(15.7%) agree, 27(7.0%) were undecided, while 15(3.9%) strongly disagreed that inordinate desires for quick wealth was the cause. Item 4 shows that 250(65.4%) strongly agreed, 92(24%) agreed, 5(1.3%) undecided and 35(9.1%) strongly disagreed that lack of knowledge fire protection devices and

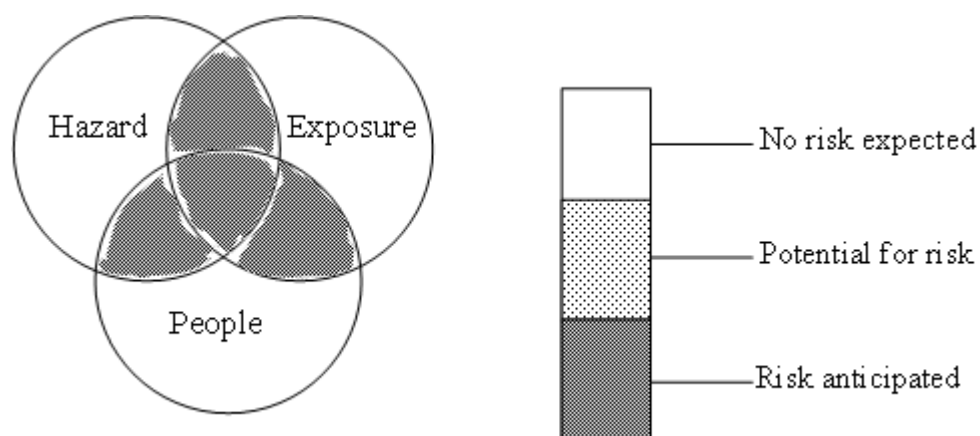


Figure 2. Element and Perception of Risks.

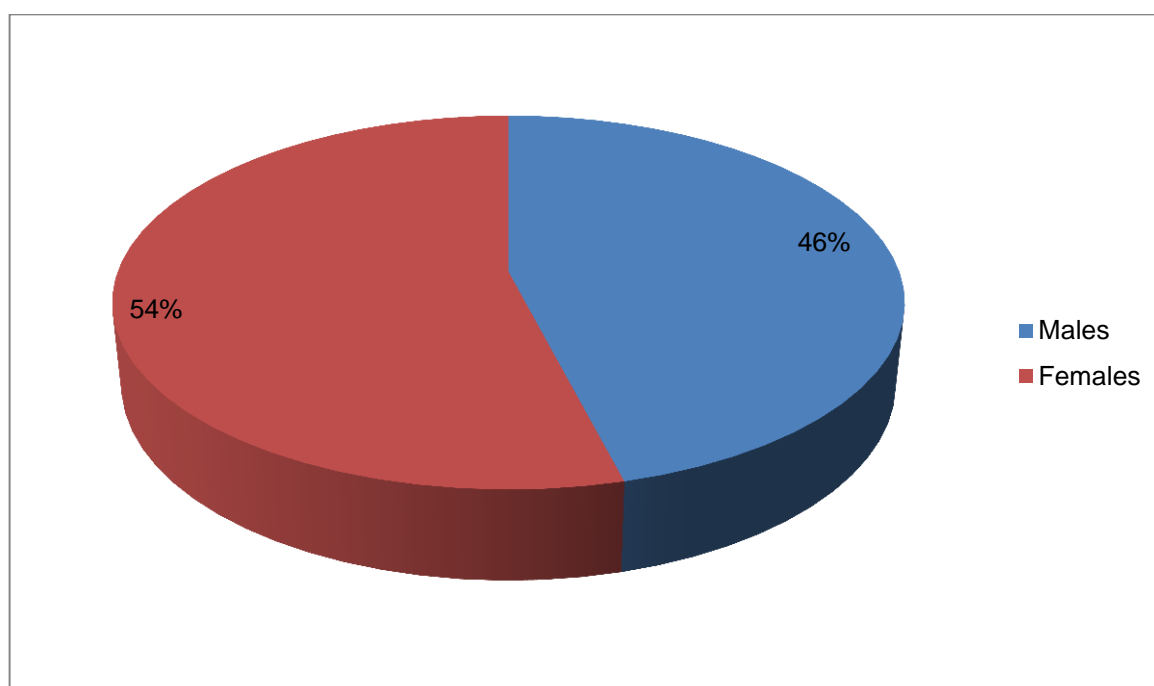


Figure 3. Showing the Responses on Gender Distribution.

gadgets were responsible. Finally item 5 shows that 270(70.6%) strongly agreed, 37(9.6%) agreed, 45(11.7%) disagrees and 30(7.8%) strongly disagree that careless disposal of lighted cigarette and matches was responsible for the frequent fire outbreaks in the markets. However, the result obtained as shown from **Table 2**, indicates that all item 1-5 have their respective mean below the

criterion mean (3.0) as a result, each of the item statement validated was accepted by the traders as possible factors responsible for incessant fire outbreaks in the markets in Port Harcourt.

Table 3 showed the perception of traders on time and season of most fire outbreaks in the markets. From item 1; about 159 (41.6%) traders strongly agree, 186(48.7%) agrees, 22(5.7%) were

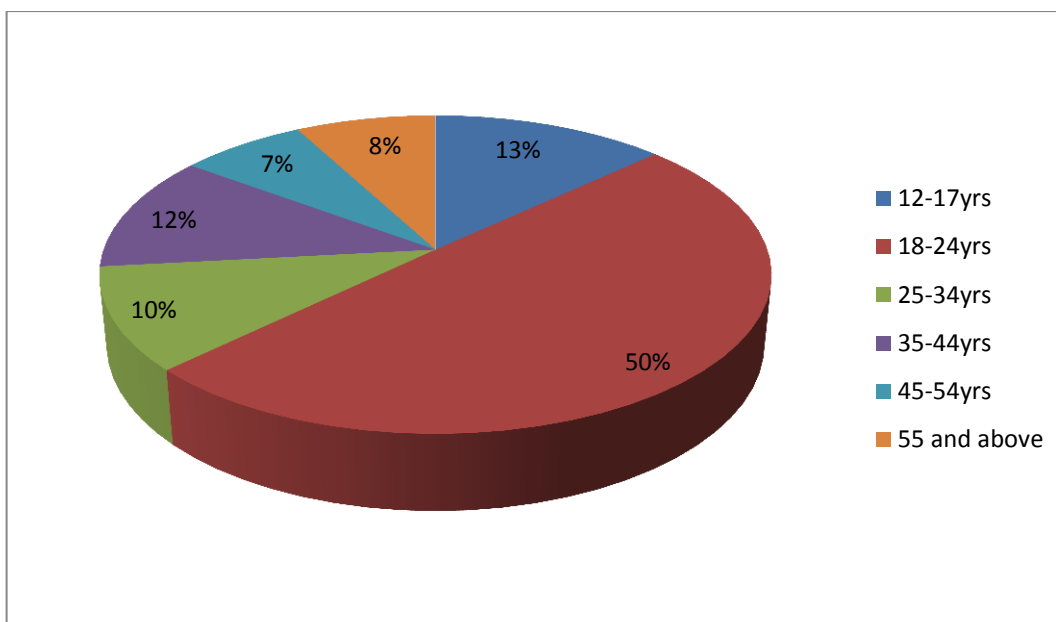


Figure 4. Showing age response categories.

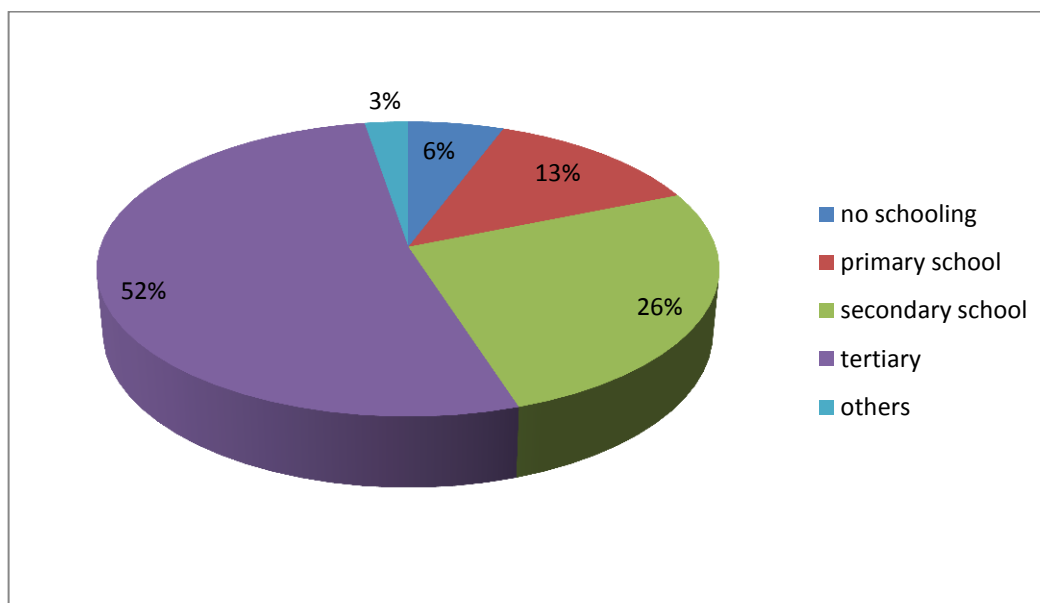


Figure 5. Showing educational attainments of respondents.

undecided while 15(3.9%) disagree that most fire incidents occurs at harmattan seasons at night. Item 2, showed that 297(77.7%) traders strongly agree that the fire incidents occurs at dry season at night, 62(16.2%) agree, 15(3.9%) undecided, 10(2.6%) disagree the fire outbreaks occurs in dry season at

night. Item 3; showed 15(3.9%) strongly agree, 170(44.5%) agree, 9(2.3%) were undecided and 188(49.2%) strongly disagree that fire outbreaks occurs during rainy season at night. Item4; showed 240(62.8%) strongly agree, 92(24.0%) agree, and 41(10.7%) disagree and 9(2.3%) strongly disagree

Table 2. Perception of traders on factors responsible for frequent fire outbreaks in the markets.

S/n	Causes of Fire	SA	A	UD	D	SD	X	Remark
1	Electrical faults	145	155	47	35	-	2.0	Accept
2	Stored fuel or other inflammable substances	175	112	65	30	-	2.0	Accept
3	Inordinate desires to make quick wealth by individuals	280	60	27	-	15	2.0	Accept
4	Lack of knowledge on use of fire protection devices and gadgets	250	92	5	-	35	2.2	Accept
5	Careless disposal of lighted cigarette and matches	270	37	-	45	30	2.4	Accept

Table 3. Perception of traders on the time and season of most fire out breaks in the markets.

S/n	Suggested time and season	SA	A	UD	D	SD	X	Remark
1	Harmattan season day or at nights	159	186	22	15	-	2.0	Accept
2	Dry season day or night	297	62	15	10	-	2.0	Accept
3	Rainy season at day or night	15	170	9	-	188	2.2	Accept
4	At any season of the year at any time	240	92	-	41	9	2.4	Accept
5	Nature induced fire	280	98	2	-	2	2.2	Accept

that fire incidents occurs at any season and time depending on the attitude of the traders on safety. Item5; showed 280(73.2%) strongly agree, and100 (26.1%) agree, (2(0.5%) undecided and 2(0.5%) strongly disagree that fire incidents at harmattan at any time (night or day). From item 1-5, have their criterion mean below (3.0) therefore validates the assertions. The revelation affirms the frequency of fire outbreaks in Port Harcourt from 2013 to 2018 and corroborated by the study in Rivers State by

(Iyaji et al., 2016).

Table 4 elicits the perception of traders on the constraints of the agencies involved in firefighting in Port Harcourt. From item 1; 159(41.6%) strong agree, 180(47.1%) agree, 28(7.3%) undecided, 15(3.9) disagree that lack of modern firefighting equipment was the constraint. Item 2; 280(73.2%) strongly agree, 96(25%) agree, 4(1.0%) disagree and 2(0.5%) strongly disagree that lack of trained personnel was the constraint. Item 3 showed that

Table 4. Perception of traders of firefighting agency's constraints in firefighting in the state.

S/n	Suggested Constraints	SA	A	UD	D	SD	X	Remark
1	Lack of modern firefighting equipment	159	180	28	15	-	2.0	Accept
2	Lack of trained personnel	280	96	-	4	2	2.4	Accept
3	Obsolete laws on fire safety	240	92	-	9	41	2.4	Accept
4	Poor sensitization of the people on fire safety	188	190	-	7	15	2.4	Accept
5	Attitudinal change of the traders on fire prevention strategies	279	62	10	-	15	2.2	Accept

240(62.8%) strongly agree, 92(24.0%) agree, 9(2.3%) disagree and, 41(10.7%) strongly disagree that the constraints was obsolete laws. Item 4; 188(49.2%) strongly agree, 190(49.7%) agree, 7(1.8%) disagree and 15(3.9%) strongly disagree that poor sensitization was the constraints. Item 5; showed 279(73%) strongly agree, 62(16.2%) agree, 10(2.6%) were undecided and 15(3.9%) strongly disagree that the constraint was attitudinal change by traders. Also from item 1-5 they all fell below the criterion mean (3.0) and were accepted.

Table 5 shows Risk Assessment Matrix Model. The risk assessment matrix is explained thus, using the three characters mentioned above; that is impact on people (P), impact on environment (E) and impact on socio-economic (S). The intersection of chosen column and a chosen row gave the risk classification. Risk is the unpleasant consequence of exposure to hazard if no action situation is applied. Some of the people in the study area have traded there since they came to Port Harcourt. Some also claimed ignorant of threats such as fire outbreaks, explosion, etc. that could result from the market. Generally, petroleum products especially petrol, chemicals or other flammable substances are not allowed to be kept in the markets. But with the poor electricity supply across the country, traders resorted to using generators in their shops and this has increased the risk and vulnerability of the markets to fire out breaks. Other unforeseen circumstances such as some traders who indulge in

cigarette smoking always throw away the butts indiscriminately, such indecent behavior could put the entire traders at risk and vulnerable to fire outbreak in the markets. The magnitude of the risk to human, environmental and socio-economic consequences of the fire outbreak was a function of exposure to the risk.

More so, able 6 above showed the effects of fire outbreaks on traders and the government. Item 1; on the table 186(48.6%) strongly agree, 159(41.6%) agree, 22(5.7%) were undecided, 15(3.9%) disagree that the effects was loss of properties and goods. Item2; 297(77.7%) strongly agree, 62(16.2%) agree, 15(3.9%) were undecided, 10(2.6%) strong disagree that high overhead cost on the government was a major effect of the fire outbreak. Item3; 188(49.2%) strongly agrees, 170(44.5%) agree, 9(2.3%) were undecided, and 15(3.9%) strongly disagree. Item 4; 249(65.1%) strongly agree, 90(23.5%) agree, 2(0.5%) undecided, and 41(10.7%) strongly disagree that fire outbreaks could lead to social vices in the society. Item 5; 208(73.2%) strongly agree, 98(25.6%) agree, 2(0.5%) were undecided, and 2(0.5%) strongly disagree. Also, the items 1-5 fell below the criterion (3.0) mean and were all accepted as effects of fire outbreaks on traders.

Finally **Table 7** showed suggested safety measure put in place by the traders to avert future occurrences. Item1 on the table showed 280 (73.2%) trader strongly agree, 97(25.3%) agree, 3(0.78%) undecided and 2 (0.5%) strongly disagree

Table 5. Risk Assessment Matrix Model on the effect of the fire outbreaks.

Consequence					Increasing Probability				
Rating	on Impact people	on Impact environment	Probability	Socio economic impact	Never heard of impact	Heard of incidence	Occurred recently	Occurred several times	Occurred some years ago
0	No injury	No impact	No damage	No impact					
1	Slight injury	Slight impact	Slight damage	Slight impact					
2	Minor injury	Minor impact	Minor damage	Minor Impact					
3	Major injury	Confined impact	Localized damage	Noticeable Impact					
4	Low Fatality	Confined impact	Localized damage	Noticeable Impact					
5	Multiple Fatality	Extensive impact	extensive damage	Colossal Impact					

LEGEND

	Low Risk
	Medium Risk
	High Risk

that installation of smoke detectors and alarms was the only measure. Item2; 297(77.7%) strongly agree, 62(16.2%) agree, 15(3.9%) were undecided and 10(2.6%) strongly disagreed. Item 3; 249(65.1%) strongly agree, 90(23.5%) agree, 2(0.5%) undecided and 41(10.7%) strongly disagreed. Item 4; 188(49%) strongly agree, 170(44.5%) agree, 9(2.3%) undecided, and 15(3.9%) strongly disagreed that enforce of law was a better measure to combat fire outbreaks.

DISCUSSION

Fire is one of the most devastating disasters that can wipe our lives and property in a jiffy. Fire outbreaks occur when heat or heating objects are exposed to combustible materials such as fuel, among others. Though fire is useful, precautionary measures have to be taken to avert its occurrence in our homes, offices, market place and environment,

because the level of destruction occasioned by fire outbreak can be mind-boggling (Iyaji et al., 2016). The risk of fire outbreak is higher in the dry season, otherwise known as the harmattan season. The harmattan season which starts between November and March, usually comes with dust and mist. Fire during this period spreads quickly because the environment is full of excessive heat and is usually difficult to contain, thus any careless handling of it can end up in monumental loss as asserted in Table 6 of this study and corroborated by (Iyaji et al., 2016). This study has revealed that it was very scary to note the number of fire incidents that had been recorded in quick succession in Rivers State particularly in the dry season was alarming from 2013 to 2018 as affirmed by traders on the season of occurrence in Table 3 of this study and corroborated by (Iyaji, et.al., 2016). The last incident was on September 2018 at popular fruit garden fire market. The overhead cost on government was huge as billions of naira would be spent to rebuild

Table 6. Effects of the fire incidents on the traders and government.

S/n	Effects of fire on traders	SA	A	UD	D	SD	X	Remark
1	Loss of good and properties by traders	186	159	22	15	-		Accept
2	High overhead cost on government to rebuild burnt market	297	62	15	-	10		Accept
3	Loss of mean of livelihood by traders	188	170	9	-	15		Accept
4	Leads to social vices and criminality	249	90	2	-	41		Accept
5	Loss of revenue by government from burnt stalls	280	98	2	-	2		Accept

Table 7. Safety Measures Put in Place to Curb Fire outbreak.

S/n	Measures	SA	A	UD	D	SD	X	Remark
1	Installation of smoke detector/alarms at markets	280	97	3	-	2		Accept
2	Installation of fire extinguisher at markets	297	62	15	-	10		Accept
3	Installation of Fire Hydrants at markets	249	90	2	-	41		Accept
4	Enforce ban on cigarette smoking at markets	188	170	9	-	15		Accept
5	Aggressive sensitization on Fire Safety at markets	186	159	22	15	-		Accept

the burnt market as shown **Figure 6. Table 6** of this study, item 2 elicits the effects of fire out break on traders. Key informant interview with chief fire officers revealed that the major causes of the fire outbreaks apart from the measures listed in **Table 2** of this research includes, ignorance, carelessness and sabotage on the part of traders and market masters. Way out in this case was the installation of water sprinklers and fire hydrant in strategic areas of the market for easy supply of water in the case of fire outbreak and adequate safety awareness

adopted by the traders to avert future incidents.

CONCLUSION

Allowing fuels and other inflammable substances in areas vulnerable to fire hazards in the markets should be discouraged. Inflammables such as rugs, PVC tiles, and carpets are means of easy spread of fires and should not be used to furnish shops in the markets. Floors of rooms should be left bare instead



Figure 6. Scene of Fire Disaster in Rumuokoro Market February, 2017.

of being finished with such materials. Instead floors should be finished with ceramic tiles or marble as means of averting fire spread. Fire incidents are not issues to toy with, as the devastating effects are massive. All traders are required to be safety conscious at all times and for all and sundry to play their role well including government agencies responsible of firefighting. The State government in 2018 has promised to establish more fire services stations in Port-Harcourt City Local Government Area, Rumuodomanya in Obio/Akpor, Degema and Ahoada LGAs respectively, with fully equipped state-of-the art facilities including accommodation comprising 3 and 2 bedroom flats, recreation

centers that could assist the fire fighters to perform their duties efficiently. Other safety measures to be adopted by the traders include, massive enlightenment and understanding of fire safety measures, some knowledge of other potential ignition sources of fires, materials such as cigarettes butts, matches and lighters, naked flames such as gas and open flame equipment, electrical, gas, oil-fired heaters, cooking and lighting equipment, faulty or unused electrical equipment, sparks and frictional heat such as from overheating, and interaction of reactive chemicals etc. must be properly handled both at markets, institutions and homes to curb fire outbreaks.

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